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GB 1481931
GB 1471633
GB 1356243
GB 1218228
GB 1068041
GB 1063736
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GB 670249
GB 588004
GB 577427
GB 573686
GB 488690
GB 170570
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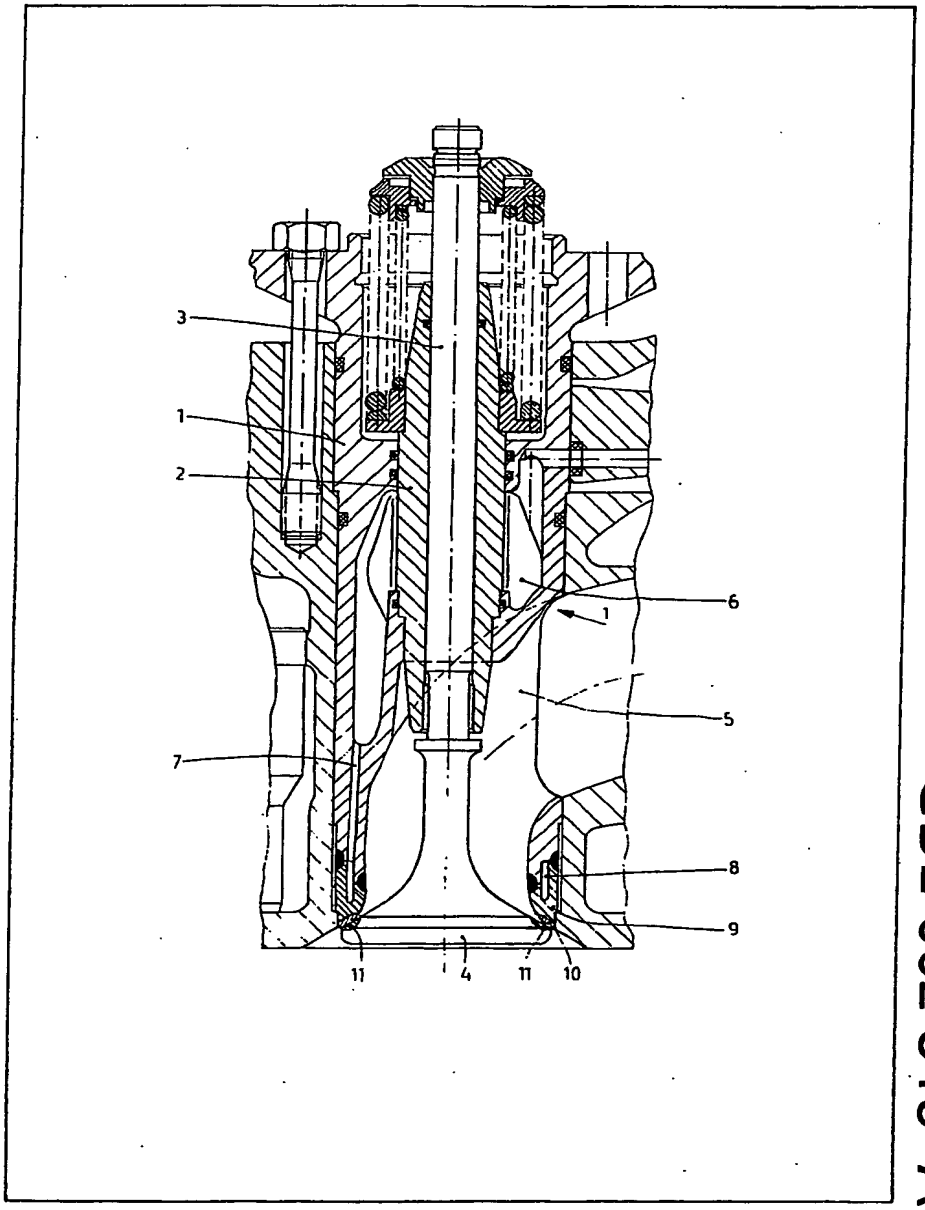
(54) **I.C. engine valve assembly**

(57) The assembly has a valve 3 and a valve cate 1, affording a seat 10 against which a face 11 of the head of the valve seats and includes means 8 for cooling the seat.

In order to make the valve face 11 and the valve seat 10 resistant to corrosion, they are each provided with armouring, the armouring of the valve face being harder than that of the valve seat. Owing to the relative hardness of the armourings, any combustion residue will not be deposited on the valve face but it may be pressed into the valve seat. However, the seat will be at a temperature at which the combustion residues will not corrode the valve seat. The valve seat may be provided by an annular element 9 welded to the cage.



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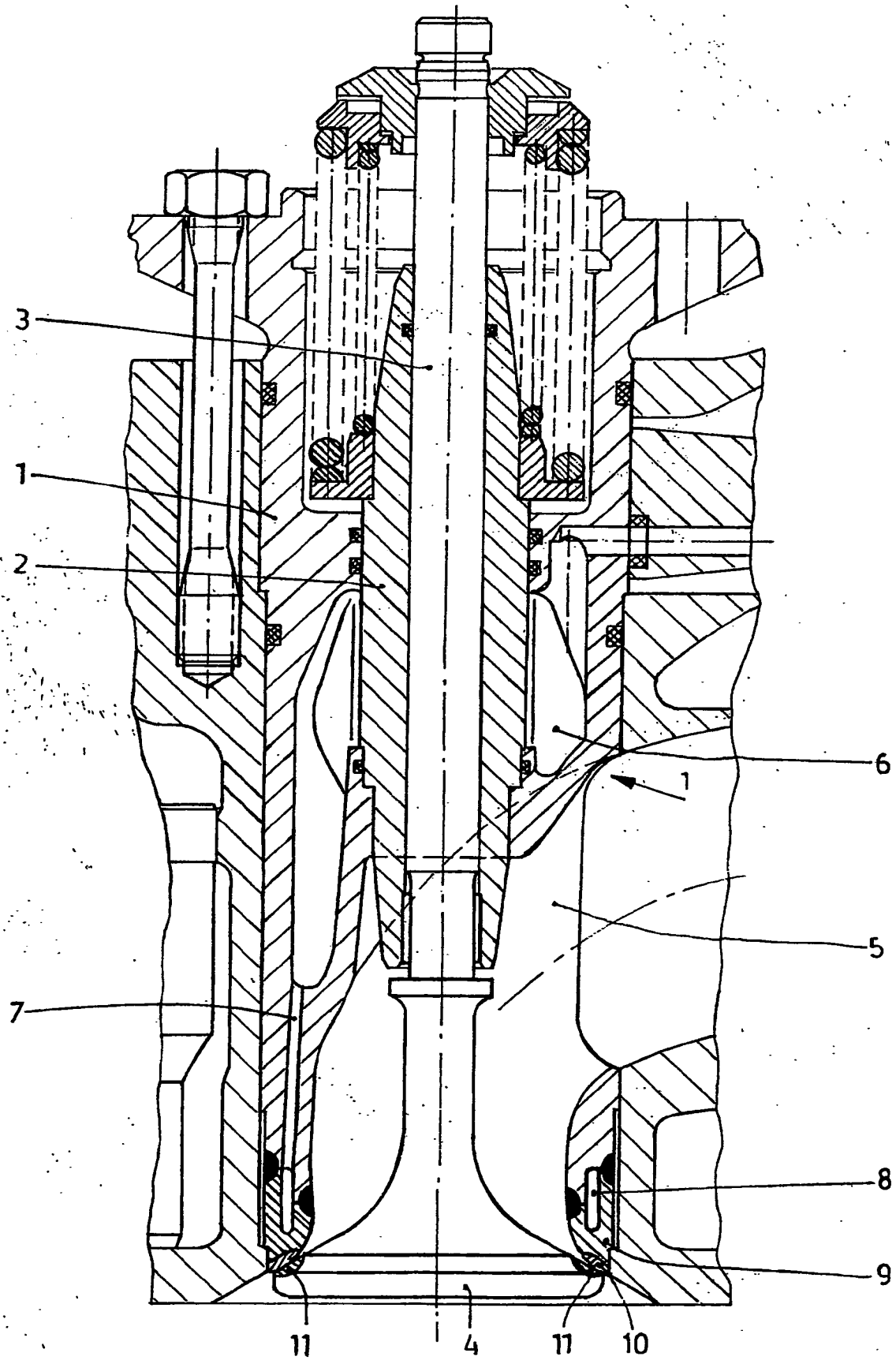

SPECIFICATION

Valve assembly for an internal combustion engine

This invention relates to a valve assembly, for an internal combustion engine, having a valve the valve head of which has a face provided with armouring, and having a valve cage affording a valve seat.

An object of the invention is to provide such a valve assembly in which the valve face and the valve seat are only slightly susceptible to corrosion and which is simple to produce and simple to overhaul.

According to the present invention there is provided a valve assembly for an internal combustion engine, comprising a valve having a valve head the face of which is provided with armouring, and a valve cage affording a valve seat against which the valve face seats and including means for cooling the valve seat, the valve seat being provided with armouring the hardness of which is lower than that of the armouring of the face of the valve.

The means for cooling the valve seat may comprise an annular coolant chamber disposed adjacent the valve seat, and the valve seat may be afforded by an annular valve seat element which is welded to the valve cage. In a preferred construction the annular coolant chamber is defined between the valve cage and the annular valve seat element. A further annular coolant chamber may also be provided, the two coolant chambers being interconnected by at least one duct. The valve cage is preferably made of cast steel.

The invention also provides a valve for an internal combustion engine and an annular valve seat element which is adapted to be welded to the body of a valve cage for the valve, the face of the valve head and the seat of the annular valve seat element each being provided with armouring, the armouring of the former being harder than the armouring of the latter.

The invention may be carried into practice in a number of ways but one specific embodiment will now be described, by way of example, with reference to the accompanying drawing which shows a longitudinal section of a valve assembly according to the invention, for a large diesel engine.

The valve assembly illustrated in the drawing comprises a valve cage 1, the body of which is made of cast steel, in which is located a valve guide 2 for guiding an exhaust valve 3 with a valve head 4. The valve cage 1 has an upper annular coolant chamber 6 situated above the exhaust gas duct 5, and this upper annular coolant chamber 6 is connected to a lower annular coolant chamber 8 by at least one connecting passage 7. The lower annular coolant chamber 8 is bounded in its upper region by the valve cage 1 and in its lower region by an annular valve seat element 9. The annular valve seat element 9 is made of cast steel, as is the body of the valve cage 1. Cast steel of the same composition may be used for both parts; in a specific construction the valve cage 1 and the annular valve seat element 9 are produced from cast steel GS 38 in conformity with DIN 1681.

ar valve seat element 9 is welded onto the body of the valve cage 1 by means of electric welding using an electrode of the same material as that of the parts to be connected. It has become evident that a welded construction does not require a subsequent annealing of the line of the weld normally required to reduce the welding stresses which can lead to a distortion of the valve cage 1. The welding can therefore be carried out after the complete processing of the valve cage 1. This has the further advantage that for the purposes of overhauling the valve assembly the annular valve seat element 9 can be separated from the body of the valve cate 1 so that the lower annular coolant chamber 8 can also be cleaned and examined. Subsequently it is possible to weld a new annular valve seat element 9 onto the body of the valve cage 1.

The production of the annular valve seat element 9 from cast steel brings with it advantages not only with regard to finishing and maintenance techniques; the high inherent damping of an annular valve seat element 9 made from cast steel also relieves the impact stress of the valve head 4 during the welding of the valve 3 and in this respect counteracts any corrosion. Non-alloy steel or low-alloy cast steel is however by itself unsuitable for the annular valve seat element since it does not possess the required rigidity in the region of the seat. In order to eliminate this defect the annular valve seat element 9 is provided with an armouring 10. Moreover, the valve face of the valve head 4 is also provided with armouring 11. When the valve is closed the armouring 11 of the valve head 4 rests against the armouring 10. Both armourings 10, 11 are made from metallic materials based on nickel or cobalt. The hardness of the armouring 11 of the valve head 4 is selected to be greater than the hardness of the armouring 10 of the annular valve seat element 9 by Rockwell hardness number C 7-10. In a specific construction the armouring 10 of the annular valve seat element 9 is made from a cobalt based material which, in addition to the cobalt base, contains 29% chromium, 9% tungsten and 1.8% carbon. The commercial name for a material of this type is "Stellit". The armouring 11 of the valve head 4 is made of a material based on nickel which, in addition to the nickel base, contains 16% chromium, 4.5% iron, 4.5% silicon, 4.5% boron and 0.5% carbon. The commercial name for a material of this type is "Colmonoy". It is possible to vary the hardness of both materials by slight changes in the amounts of chromium, carbon and, where necessary, tungsten.

When solid residues from combustion arrive between the armourings 10, 11 the variation of the hardness ensures that these residues cannot be deposited on the harder armouring 11 but could possibly be crushed into the softer armouring 10. However, the temperature of this armouring 10 lies considerably below the temperature of the armouring 11 owing to the cooling by the cooling medium in the adjacent annular coolant chamber 8. For example, temperatures of 500° Celsius have been measured on the armouring 11 whilst temperatures of only 300° Celsius have been measured simultaneously on the armouring 10. The temperature of the armouring 10 is therefore at a level at which no sof-

tening of the combustion residues occurs to form aggressive fusing which acts on the armouring 10. Using the armourings specified, based on nickel and cobalt, the difference in hardness can be maintained even with changes in operating temperature. It cannot happen, therefore, that at higher temperatures the temperature-dependent hardness of the armouring 11 sinks below the hardness of a hardened annular valve seat element the hardness of which remains to a large extend constant within a certain temperature range, as is the case with valve assemblies wherein the valve head is armoured and wherein the annular valve seat elements are made from a hardened, alloyed steel, so that the residues are driven into the then softer valve head and fuse there owing to the high temperatures.

CLAIMS

1. A valve assembly for an internal combustion engine, comprising a valve having a valve head the face of which is provided with armouring, and a valve cage affording a valve seat against which the valve face seats and including means for cooling the valve seat, the valve seat being provided with armouring the hardness of which is lower than that of the armouring of the face of the valve.

2. A valve assembly as claimed in claim 1, in which the valve seat of the valve cage is afforded by an annular valve seat element which is welded to the body of the valve cage.

3. A valve assembly as claimed in claim 1 or claim 2, in which the valve cage includes as the means for cooling the valve seat an annular coolant chamber disposed adjacent the valve seat.

4. A valve assembly as claimed in claim 3 when dependent on claim 2, in which the annular coolant chamber is defined between the body of the valve cage and the annular valve seat element.

5. A valve assembly as claimed in claim 3 or claim 4, in which there is provided a further annular coolant chamber disposed further from the valve seat than the said annular coolant chamber which is disposed adjacent the valve seat, the two annular coolant chambers being interconnected by at least one duct.

6. A valve assembly as claimed in any one of the preceding claims, in which the body of the valve cage is made of cast steel.

7. A valve assembly as claimed in any one of the preceding claims, in which the valve cage is provided with a valve guide.

8. A valve assembly as claimed in claim 2 or in any claim when dependent on claim 2, in which the annular valve seat element is made of cast steel GS 38 (DIN 1681).

9. A valve assembly as claimed in any one of the preceding claims, in which the armourings of the valve seat and of the face of the valve head are made of metallic materials based on cobalt or nickel.

10. A valve assembly as claimed in any one of the preceding claims, in which the hardness of the armouring of the face of the valve head is greater than the hardness of the armouring of the valve seat by Rockwell hardness C 7-10.

11. A valve assembly substantially as specifically described herein with reference to the accompanying drawing.

12. An internal combustion engine having a valve assembly as claimed in any one of the preceding claims, the valve being an exhaust valve.

13. A valve for an internal combustion engine and an annular valve seat element which is adapted to be welded to the body of a valve cage for the valve, the face of the valve head and the seat of the annular valve seat element each being provided with armouring, the armouring of the former being harder than the armouring of the latter.

14. A valve and valve seat element as claimed in claim 12, in which the valve seat element is made of cast steel GS 38 (DIN 1681).

15. A valve and valve seat element as claimed in claim 13 or claim 14, in which the armourings of the valve seat and the face of the valve are made of metallic materials based on cobalt or nickel.

16. A valve and valve seat element as claimed in any one of claims 13 to 15, in which the hardness of the armouring of the valve face is greater than that of the armouring of the valve seat by Rockwell hardness C 7-10.

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